

# Traffic Deaths

## *A Preliminary Study of Urban and Rural Fatalities in California*

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■ *An analysis by the California Department of Public Health of California Highway Patrol reports for 1961 showed that traffic accidents injured one and one-half times as many people per 1,000 population in rural California counties (under 50,000 people) as in urban counties (over 500,000 people); also persons injured in rural counties were almost four times as likely to die of their injuries as those injured in urban counties.*

*A death certificate study was undertaken of 782 traffic deaths (excluding pedestrians) occurring in rural and urban California counties during 1961. Accidents occurring in rural counties tended to be single vehicle accidents which resulted in less severe injuries, while those in urban counties tended to be two vehicle and multiple vehicle accidents resulting in more serious injuries. The anatomic distribution of injuries was the same for both urban and rural accidents. However, people dying in rural accidents more frequently died at the scene of the accident, died sooner after injury, and died of less serious injuries than did those injured in urban accidents. For injuries where theoretically few lives should be salvaged by prompt emergency care, the time between injury and death was about the same in urban as in rural counties. Where such care should delay or prevent death because the injury was possibly or probably salvageable, those injured in rural counties died more quickly.*

*Thirty-two per cent of fatalities in rural counties happened to urban and out-of-state residents, while only 12 per cent of fatalities in urban counties were to rural or out-of-state residents, suggesting that traffic accidents to non-residents may place an excessive load upon medical care resources in rural areas.*

AN ANALYSIS by the California Department of Public Health of California Highway Patrol data for 1961 showed that there were many more traffic injuries and fatalities per thousand population occurring in the 24 rural counties (those with population less than 50,000) than in the 34 more populous counties of the State, and that of people injured in rural counties, almost four times as many died as of those injured in counties with over 500,000 residents (Table 1).

Because most of the very rural counties also are quite mountainous, and are used as recreational areas, several questions were raised.

1. Are the road conditions or driving conditions in rural counties such that injury and fatality producing accidents are more likely to occur than in urban counties?

2. Are the excessive injury and fatality rates per thousand residents in rural counties explained by an influx of urban and out-of-state drivers who are involved in accidents while using rural areas for recreational and other purposes?

3. Is the higher case fatality ratio in rural counties explained by factors occurring after the accident has happened, such as delay in discovering the accident, difficulty in getting emergency medical care to the scene of the accident, greater distances from hospital facilities, and perhaps less specialized rescue and medical facilities of all types than might be found in urban areas?

A preliminary death certificate study was undertaken of 782 traffic fatalities occurring during 1961 in highly rural counties (fewer than 50,000 residents) and highly urban counties (over 500,000 residents) in order to answer these questions.

## Method

For the year 1961 all death certificates for traffic fatalities (excluding pedestrian, motorcycle, and bicycle deaths) occurring in rural California counties (under 50,000 people), and 50 per cent of the certificates for similar traffic fatalities in urban counties (over 500,000 people) were studied. Of 820 certificates, 38 were excluded because the victim, although involved in a vehicular accident, did not meet criteria of being enclosed or "packaged" in the vehicle at the time of the accident. The final sample of 782 certificates included 251 fatalities occurring in rural counties, and 531 occurring in urban counties.

The certificates were analyzed by age, sex, and county of residence of the person; county of injury

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Submitted January 17, 1964.

and death; distance between place of injury and place of death; time interval between injury and death; date, day of week, and hour of injury; and type of accident (single vehicle, multiple vehicle, etc.). In addition an analysis was made of the anatomic areas injured and of the nature of the injuries (fracture, contusion, etc.). Also an estimate was made of the *presumed salvageability*\* of the injury listed as the primary cause of death.

## Results

*Question 1: Are road conditions or driving conditions in rural counties such that injury and fatality-producing accidents are more likely to occur than in urban counties?*

Criteria for measuring the severity of an accident may include speed at time of impact, type of collision and extent of injury to the vehicle and to the occupants. Because police reports of the accidents were not available at this time, it was not possible to determine speed or damage to the vehicle. However, it was found that single vehicle non-collision accidents (such as skids and rollovers) more frequently occurred in rural counties, while two car and multiple car collisions were more frequent in urban counties (Table 2). Since two car and multiple car collisions more often involve the additive forces of two or more missiles, it is reasonable to assume that urban accidents in this study tended to be more severe. This was supported by the finding of a direct progression of nonsalvageable injuries with accident type, single vehicle non-collision accidents having the smallest proportion of nonsalvageable injuries, and multiple vehicle and vehicle versus train collisions having the highest proportion (Chart 1). Thus, it would appear that rural counties, rather than having more serious types of accidents, seem to have somewhat less serious ones.

*Question 2: Are the excessive injury and fatality rates per thousand residents in rural counties ex-*

\*Presumed salvageability is an estimate of the individual's probable chances for survival if immediate and adequate emergency medical care and first aid had been available. Two criteria were used in assessing salvageability. First, on the basis of clinical judgment, injuries in a sample of 1960 certificates were grouped into categories of *probably not salvageable*, *possibly salvageable*, *probably salvageable*, and *salvageability unknown*. For instance, death from external hemorrhage was considered as probably salvageable while that from brain laceration was considered probably not salvageable.

Next, several series of cases of automotive trauma requiring hospitalization were reviewed in the medical literature after a previous decision that a death rate of approximately 25 per cent in a group of patients with a given type of injury would classify that injury as *probably salvageable*, while a death rate of 50 per cent would be considered as indicating the injury was of the *possibly salvageable* category and one of 75 per cent would classify the injury as *not salvageable*. In every instance except one there was agreement between the clinical estimate and the more objective criterion of actual per cent of deaths occurring from a specific type and location of injury. Where a vague cause of death, such as "multiple trauma," was listed, the injury was classified as *salvageability unknown*. Because autopsy records, although in existence, were not readily available it was not possible to obtain more specific information about these deaths at the present time. This will be done before further studies are undertaken. The salvageability scale based on these criteria was then applied to the death certificates for 1961.

plained by an influx of urban and out-of-state drivers who are involved in accidents while using rural areas for recreational and other purposes?

Twenty-one per cent of fatalities occurring in rural counties were to residents of urban counties, and 11 per cent were to out-of-state residents. Of fatalities occurring in urban counties only 6 per cent were to rural residents, and 6 per cent to out-of-state

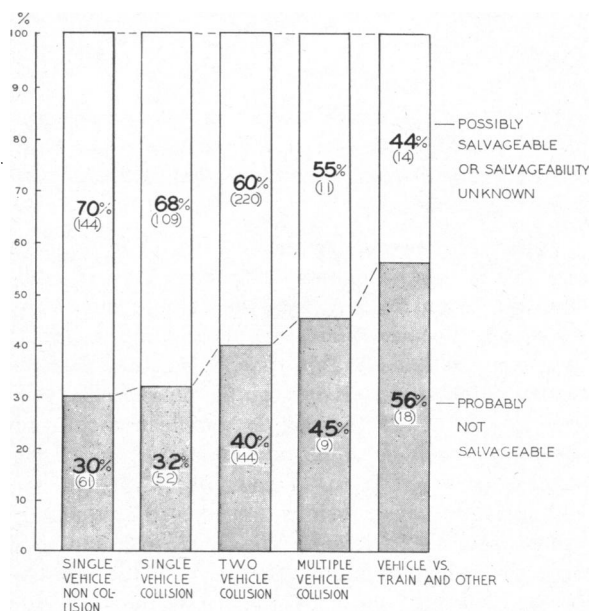


Chart 1.—Proportion of fatalities with injuries probably not salvageable by type of traffic accident, California, 1961.

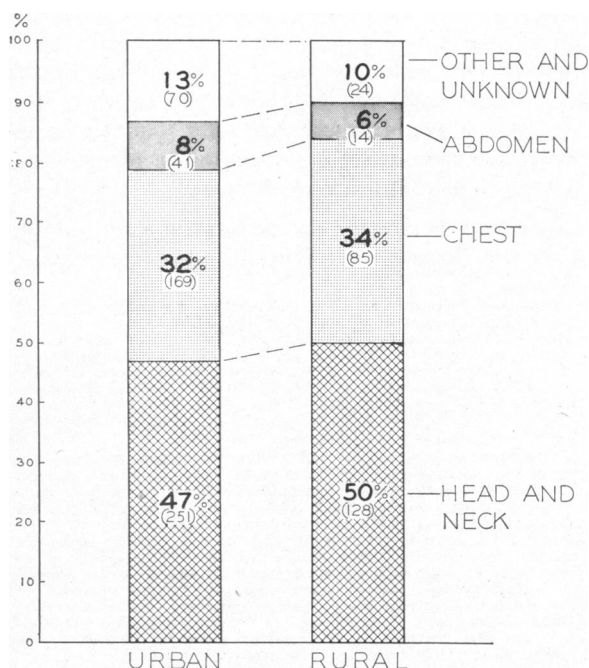


Chart 2.—Anatomic distribution of traffic injuries causing fatality in urban and rural California counties, 1961.

residents. Thus, almost three times as many of the fatalities in rural counties were to nonresidents as in the urban counties. However, the large number of nonresidents dying in rural counties does not completely explain the excessive fatality rate in these counties. If traffic death rates in rural counties to rural residents are compared with death rates in urban counties to urban residents, it is found that rural residents still had at least twice the risk of dying in an automobile accident as did urban residents. The fact that so large a proportion of the deaths occurring in rural areas involved nonresidents does not alter the fact that the rural resident himself was at greater risk of dying in an automobile accident than if he were an urban resident.

TABLE 1.—California Traffic Injuries and Fatalities by Urban and Rural County of Occurrence, 1961

	Urban Counties	Rural Counties
Injuries/1,000 population .....	9.17	13.72
Fatalities/1,000 population .....	0.153	0.636
Case fatality ratio.....	0.013	0.047

Source: State of California, Department of Public Health, *California Health Trends*. State of California, Department of Highway Patrol—*Annual Statistical Report*, 1961.

TABLE 2.—Type of Traffic Accident Leading to Fatality by Urban and Rural County of Occurrence—California, 1961

Type of Accident	County of Occurrence	
	Urban	Rural
Single vehicle, noncollision.....	21%	38%
Single vehicle, collision.....	21	21
Two vehicles, collision.....	51	36
Multiple vehicle, collision.....	3	1
Vehicle vs. train, and other.....	4	4
Total per cent.....	100	100
Total numbers .....	531	251

TABLE 3.—Place of Residence for Persons Fatally Injured in Urban and Rural County, and Hour in Which Injury Occurred

	Hour Injury Occurred			
	Midnight-6 a.m. Per Cent	6 a.m.-Noon Per Cent	Noon-6 p.m. Per Cent	6 p.m.-Midnight Per Cent
Urban accidents				
Urban residents .....	86	86	88	89
Rural residents .....	5	9	4	7
Out-of-state residents .....	9	5	8	4
Total per cent..	100	100	100	100
Total numbers...	144	98	129	160
Rural accidents				
Urban residents .....	32	16	17	19
Rural residents .....	58	67	70	75
Out-of-state residents .....	10	18	13	6
Total per cent..	100	100	100	100
Total numbers...	62	45	75	69

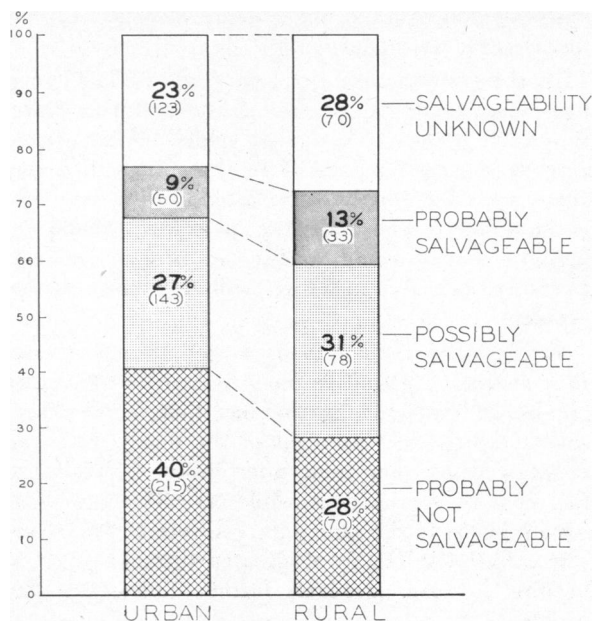


Chart 3.—Estimated salvageability of injury causing death in urban and rural California traffic fatalities, 1961.

*Question 3: Is the higher case fatality ratio in rural counties explained by factors occurring after the accident has happened, such as delay in discovering the accident, difficulty in getting emergency medical care to the scene of the accident, greater distances from hospital facilities, and perhaps less specialized rescue and medical facilities of all types than might be found in urban areas?*

While the death certificate contains no specific information about the time lapse before an accident is discovered, analysis of the data available did yield some suggestive facts. No matter what hour of the day the injury occurred, 85 to 90 per cent of the fatally injured in urban counties were urban residents. In contrast, between the hours of 6 p.m. and midnight 75 per cent of the rural injuries were to rural residents, but during the next six hours, until 6 a.m. only 58 per cent were to rural residents (Table 3). It is reasonable to assume that accidents occurring during the early hours of the morning are

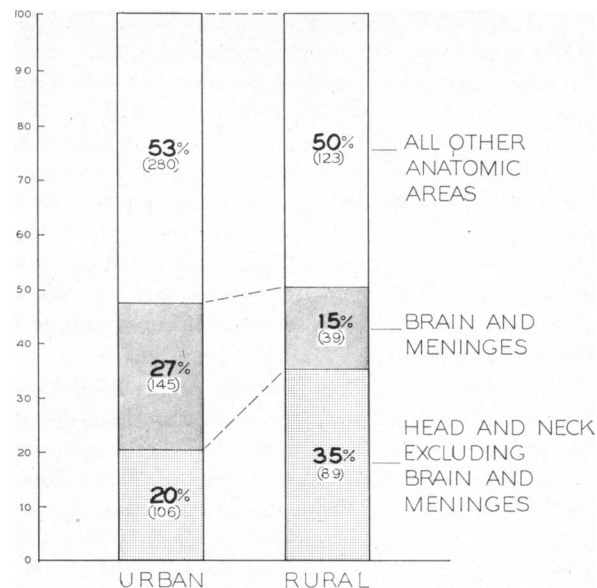


Chart 4.—Proportion of traffic fatalities from injury to head and neck excluding brain and meninges, and from brain or meninges injury only, in urban and rural California counties, 1961.

less likely to be discovered immediately, especially if they involve people whose presence in the county is not known or expected. In addition, in many accidents it is possible for one of the less injured occupants to seek aid. The chances for this occurring would be greater in a two car collision than in a single car collision, which was the more frequent type in rural counties.

Injuries to the head, chest and abdomen were the primary cause of almost 90 per cent of fatalities in both urban and rural areas. Although the distribution of injuries among these three anatomic areas was essentially the same in both urban and rural counties (Chart 2) only 38 per cent of the injuries occurring in rural counties were considered not to be salvageable, while 53 per cent of those in urban counties were so classified. In approximately 25 per cent of the deaths in both areas it was not possible to estimate salvageability because of inadequacy of information on the death certificate (Chart 3).

TABLE 4.—Proportion of Deaths Occurring at Given Time Intervals After Injuries to Specific Anatomic Areas in Urban and Rural California Traffic Fatalities

Survival After Injury	Chest		Abdomen		Head and Neck Excluding Brain and Meninges		Brain and Meninges	
	Urban Per Cent	Rural Per Cent	Urban Per Cent	Rural Per Cent	Urban Per Cent	Rural Per Cent	Urban Per Cent	Rural Per Cent
Under 1 hour.....	59	75	46	50	69	80	55	56
1 to 4 hours.....	21	13	17	43	12	12	12	8
5 to 24 hours.....	7	2	10	7	8	0	12	10
Over 25 hours.....	14	9	27	0	12	8	21	26
Total per cent.....	100	100	100	100	100	100	100	100
Total numbers.....	169	85	41	14	106	89	145	39

The difference between urban and rural is especially apparent with injuries to the head and neck. Fatalities from these injuries in urban counties were much more frequently the result of damage to the brain and meninges than in the rural counties. (Chart 4). Also it was noted that people injured in rural accidents tended to die more rapidly than those in urban accidents from injuries to chest, abdomen and head, excluding brain and meninges, but showed no difference in time of survival where the primary cause of death was brain or meningeal damage (Table 4).

Ninety per cent of the fatalities occurring during the first hour after injury in rural counties were at the scene of the accident. Only 37 per cent of those dying in the same time interval after urban accidents had not been moved from the scene. Those rurally injured who were moved before death frequently were taken over 25 miles from the place of injury, but almost all of the fatally injured in urban counties reached hospitals within 10 miles of the accident (Table 5).

## Discussion

It would appear from the data that the proportion of the severe types of vehicular accidents is higher in urban than in rural areas. Therefore the explanation for the higher case fatality ratio in rural counties probably cannot be found in the assumption that rural accidents involve more severe impacts. The

answer seems to lie in the factors which occur after the accident has happened.

By their very nature, rural accidents are less likely to be immediately discovered. Rural accidents more frequently involve only a single vehicle. Those occurring in the early hours of the morning when the roads are least heavily traveled tend to involve non-rural residents whose absence or excessive delay in arriving home would arouse no concern among friends or relatives in the immediate vicinity of the accident.

Once a rural accident is discovered, transportation to a source of definitive medical care is harder to obtain, as indicated by the fact that, despite less severe injuries, 90 per cent of the deaths in rural counties within one hour after injury occurred at the scene of the accident, while only 37 per cent of urban deaths in the same interval were at the scene. The additional factor of greater distance from a hospital in rural accidents further compounds the problem.

As to injuries (such as to the brain) where it can be postulated that early and adequate medical care will be of only limited usefulness, no difference could be found between urban and rural fatalities in the time interval between injury and death. However, in every case where it could be postulated that early and adequate care might delay or prevent death, death in rural counties takes place sooner than in the urban counties. This is especially striking with regard to injuries to the head and neck without brain or meningeal damage. Such injuries often result in aspiration of blood, vomitus or dentures and in edema and instability of mouth and neck structures. It therefore is felt that many of the deaths from injuries of this kind may have been due simply to inadequate maintenance of airway and respiratory mechanisms, perhaps because the injured person was not found soon enough, or perhaps because there was no one in constant attendance during transportation to the hospital or the person in attendance at the scene or during transportation was not adequately trained in the procedures necessary to provide respiratory assistance.

Much attention has been focused in recent years on the difficulties in obtaining sufficient rural medical resources. The number of physicians per 1,000 resident population has consistently been lower in less densely populated areas. This study further emphasizes the medical burden of the rural area, since it not only must care for its own sick and injured with fewer physicians and fewer hospital beds, but also must handle a comparatively larger influx of injured transients than is likely to be encountered in urban communities.

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TABLE 5.—Distance Patient Was Transported Before Death, as Related to Various Time Intervals of Survival, in Traffic Fatalities Occurring in Urban and Rural California Counties, 1961

Distance Transported Between Injury and Death	Duration of Survival		
	Under 1 Hour Per Cent	1 to 4 Hours Per Cent	Over 5 Hours Per Cent
Died at scene of accident			
Urban .....	37	2*	1*
Rural .....	90	11	0
Under 10 miles			
Urban .....	59	83	77
Rural .....	9	61	43
10 to 25 miles			
Urban .....	3	10	11
Rural .....	2*	18	24
Over 25 miles			
Urban .....	1*	4*	11
Rural .....	0	11*	32
Total			
Urban (per cent) .....	100	100	100
Urban (numbers) .....	310	90†	128†
Rural (per cent) .....	100	100	100
Rural (numbers) .....	183	28†	37

\*Based on fewer than 5 deaths.

†In an additional 6 cases distance between site of injury and site of death was unknown.